a turning mirror; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system, and

the turning mirror is disposed near the intermediate image and/or the image of the intermediate image.

45. (NEW) The catadioptric optical system according to claim 44, wherein the turning mirror is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

46. (NEW) The catadioptric optical system according to claim 45, wherein the turning mirror turns an optical path at right-angles.

47. (NEW) The catadioptric optical system according to claim 46, wherein the turning mirror has a plane reflection surface.

48. (NEW) The catadioptric optical system according to claim 45, wherein the turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

49. (NEW) The catadioptric optical system according to claim 44, wherein the turning mirror turns an optical path at right-angles.

50. (NEW) The catadioptric optical system according to claim 44, wherein the turning mirror has a plane reflection surface.

51. (NEW) The catadioptric optical system according to claim 50, further comprising a plurality of refractive elements and a pupil, wherein the pupil of the catadioptric optical system is formed in a space between the refractive elements.

52. (NEW) The catadioptric optical system according to claim 51, wherein the refractive elements comprise a first lens and a second lens, wherein the pupil of the catadioptric optical system is formed in a space between the first lens and the second lens.

53. (NEW) The catadioptric optical system according to claim 51, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

54. (NEW) The catadioptric optical system according to claim 44, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

55. (NEW) The catadioptric optical system according to claim 44, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

56. (NEW) The catadioptric optical system according to claim 55, wherein the turning mirror is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

57. (NEW) The catadioptric optical system according to claim 56, wherein the turning mirror turns an optical path at right-angles.

58. (NEW) The catadioptric optical system according to claim 57, wherein the turning mirror has a plane reflection surface.

59. (NEW) The catadioptric optical system according to claim 44, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

60. (NEW) The catadioptric optical system according to claim 59, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

61. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system, and

at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system and between the refractive-reflective optical sub-system and the second refractive optical sub-system is turned at right angle.

62. (NEW) The catadioptric optical system according to claim 61, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

63. (NEW) The catadioptric optical system according to claim 62, wherein the turning mirror has a plane reflection surface.

64. (NEW) The catadioptric optical system according to claim 61, wherein a turning mirror is not disposed in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

65. (NEW) The catadioptric optical system according to claim 61, further comprising a plurality of refractive elements and a pupil, wherein the pupil of the catadioptric optical system is formed in a space between the refractive elements.

66. (NEW) The catadioptric optical system according to claim 61, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

67. (NEW) The catadioptric optical system according to claim 66, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

68. (NEW) The catadioptric optical system according to claim 61, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

69. (NEW) The catadioptric optical system according to claim 68, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

70. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system;

a pupil; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system,

the first and the second refractive optical sub-system include a plurality of refractive elements, and

the pupil is disposed in a space between the plurality of refractive elements.

71. (NEW) The catadioptric optical system according to claim 70, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

72. (NEW) The catadioptric optical system according to claim 71, wherein the turning mirror turns an optical path at right-angles.

73. (NEW) The catadioptric optical system according to claim 72, wherein the turning mirror has a plane reflection surface.

74. (NEW) The catadioptric optical system according to claim 71, wherein the turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

75. (NEW) The catadioptric optical system according to claim 70, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

76. (NEW) The catadioptric optical system according to claim 70, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

77. (NEW) The catadioptric optical system according to claim 76, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

78. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system,

the first and the second refractive optical sub-system include a plurality of refractive elements, and

the catadioptric optical system images through unobscuration of an imaging light beam.

79. (NEW) The catadioptric optical system according to claim 78, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

80. (NEW) The catadioptric optical system according to claim 79, wherein the turning mirror has a plane reflection surface.

81. (NEW) The catadioptric optical system according to claim 80, wherein the turning mirror turns an optical path at right-angles.

82. (NEW) The catadioptric optical system according to claim 79, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

83. (NEW) The catadioptric optical system according to claim 78, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

84. (NEW) The catadioptric optical system according to claim 83, wherein a turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

85. (NEW) The catadioptric optical system according to claim 78, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

86. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system,

the first and the second refractive optical sub-system include a plurality of refractive elements,

the first refractive optical sub-system includes a field lens which is disposed near the intermediate image, and

the second refractive optical sub-system includes a field lens which is disposed near the image of the intermediate image.

87. (NEW) The catadioptric optical system according to claim 86, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

88. (NEW) The catadioptric optical system according to claim 87, wherein the turning mirror has a plane reflection surface.

89. (NEW) The catadioptric optical system according to claim 88, wherein the turning mirror turns an optical path at right-angles.

90. (NEW) The catadioptric optical system according to claim 86, wherein a turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

91. (NEW) The catadioptric optical system according to claim 86, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

92. (NEW) The catadioptric optical system according to claim 91, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

93. (NEW) The catadioptric optical system according to claim 86, wherein the field lenses have a positive refractive power.

94. (NEW) The catadioptric optical system according to claim 93, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

95. (NEW) The catadioptric optical system according to claim 86, wherein:

the field lens of the first refractive optical sub-system is adjacent to the intermediate image, and

the field lens of the second refractive optical sub-system is adjacent to the image of the intermediate image.

96. (NEW) The catadioptric optical system according to claim 95, wherein the field lenses have a positive refractive power.

97. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system; and

a second refractive optical sub-system;

wherein:

first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system, and

the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

98. (NEW) The catadioptric optical system according to claim 97, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

99. (NEW) The catadioptric optical system according to claim 98, wherein the turning mirror turns an optical path at right-angles.

100. (NEW) The catadioptric optical system according to claim 99, wherein the turning mirror has a plane reflection surface.

101. (NEW) The catadioptric optical system according to claim 98, wherein the turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

102. (NEW) The catadioptric optical system according to claim 97, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

103. (NEW) A catadioptric optical system comprising:
a first refractive optical sub-system;
a refractive-reflective optical sub-system;
a second refractive optical sub-system;
a first lens;
a second lens; and
a pupil formed in a space between the first and the second lens,
wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system, and

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system.

104. (NEW) The catadioptric optical system according to claim 103, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

105. (NEW) The catadioptric optical system according to claim 104, wherein the turning mirror turns an optical path at right-angles.

106. (NEW) The catadioptric optical system according to claim 105, wherein the turning mirror has a plane reflection surface.

107. (NEW) The catadioptric optical system according to claim 103, wherein a turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

108. (NEW) The catadioptric optical system according to claim 103, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

109. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system, and

a turning mirror is not disposed in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

110. (NEW) The catadioptric optical system according to claim 109, further comprising a turning mirror which is disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

111. (NEW) The catadioptric optical system according to claim 110, wherein the turning mirror turns an optical path at right-angles.

112. (NEW) The catadioptric optical system according to claim 111, wherein the turning mirror has a plane reflection surface.

113. (NEW) The catadioptric optical system according to claim 109, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

114. (NEW) The catadioptric optical system according to claim 113, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

115. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system;

a second refractive optical sub-system; and

a turning mirror which is disposed in at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and an optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in the optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system, and

said refractive-reflective optical sub-system forms an image of said intermediate image in the optical path between said refractive-reflective optical sub system and said second refractive optical sub-system.

116. (NEW) The catadioptric optical system according to claim 115, wherein the turning mirror turns an optical path at right-angles.

117. (NEW) The catadioptric optical system according to claim 116, wherein the turning mirror has a plane reflection surface.

118. (NEW) The catadioptric optical system according to claim 115, wherein the turning mirror has a plane reflection surface.

119. (NEW) The catadioptric optical system according to claim 115, wherein the turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

120. (NEW) The catadioptric optical system according to claim 115, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

121. (NEW) A catadioptric optical system which is optically conjugate with respect to a first surface and a second surface, comprising:

a first refractive optical sub-system, arranged in an optical path between the first and the second surfaces;

a refractive-reflective optical sub-system, arranged in an optical path between the first refractive optical sub-system and the second surface;

a second refractive optical sub-system, arranged in an optical path between the refractive-reflective optical sub-system and the second surface; and

a turning mirror, arranged in at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and an optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system,

wherein conjugate points of the first and the second surface are formed in the optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and in the optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

122. (NEW) The catadioptric optical system according to claim 121, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

123. (NEW) The catadioptric optical system according to claim 122, wherein:

the field lens of the first refractive optical sub-system is adjacent to the intermediate image, and

the field lens of the second refractive optical sub-system is adjacent to the image of the intermediate image.

124. (NEW) The catadioptric optical system according to claim 123, wherein each of the field lenses has a positive refractive power.

125. (NEW) The catadioptric optical system according to claim 122, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

126. (NEW) The catadioptric optical system according to claim 122, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

127. (NEW) The catadioptric optical system according to claim 122, wherein the turning mirror turns an optical path at right-angles.

128. (NEW) A catadioptric optical system which optically conjugate a first surface and a second surface, comprising:

a first refractive optical sub-system, arranged in an optical path between the first and the second surfaces;

a refractive-reflective optical sub-system, arranged in an optical path between the first refractive optical sub-system and the second surface;

a pupil; and

a second refractive optical sub-system, arranged in an optical path between the refractive-reflective optical sub-system and the second surface,

wherein:

the first refractive optical sub-system comprising a first lens group which is arranged in an optical path between the first surface and the refractive-reflective optical sub-system, and a second lens group which is arranged in an optical path between the first lens group and the refractive-reflective optical sub-system,

the second refractive optical sub-system comprising a third lens group which is arranged in an optical path between the refractive-reflective optical sub-system and the second surface, and the fourth lens group which is arranged in an optical path between the third lens group and the second surface,

the pupil of the catadioptric optical system is formed in at least one of a space between the first lens group and the second lens group and a space between the third lens group and the fourth lens group, and

conjugate points of the first and the second surface are formed in the optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and in the optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

129. (NEW) The catadioptric optical system according to claim 128, wherein the second lens group and the third lens group are adjacent to the conjugate points of the first and the second surface.

130. (NEW) The catadioptric optical system according to claim 129, further comprising a turning mirror disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system.

131. (NEW) The catadioptric optical system according to claim 130, wherein the turning mirror has a plane reflection surface.

132. (NEW) The catadioptric optical system according to claim 128, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

133. (NEW) A catadioptric optical system which optically conjugate a first surface and a second surface, comprising:

a first refractive optical sub-system, arranged in an optical path between the first and the second surfaces;

a refractive-reflective optical sub-system, arranged in an optical path between the first refractive optical sub-system and the second surface;

a second refractive optical sub-system, arranged in an optical path between the refractive-reflective optical sub-system and the second surface; and

at least one turning mirror disposed between the first refractive optical sub-system and the refractive-reflective optical sub-system and/or between the refractive-reflective optical sub-system and the second refractive optical sub-system,

wherein:

the refractive-reflective optical sub-system includes only one concave reflective surface,

all the turning mirrors, arranged in at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system and an optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system, having a plane reflection surface, and

conjugate points of the first and the second surface are formed in the optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and in the optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

134. (NEW) The catadioptric optical system according to claim 133, wherein the first refractive optical sub-system and the refractive-reflective optical sub-system have a common optical axis.

135. (NEW) The catadioptric optical system according to claim 134, wherein a number of the turning mirrors is one.

136. (NEW) The catadioptric optical system according to claim 133, wherein the refractive-reflective optical sub-system including a lens.

137. (NEW) The catadioptric optical system according to claim 136, wherein the lens of the refractive-reflective optical sub-system is a meniscus lens of which a convex surface faces the concave reflective surface.

138. (NEW) The catadioptric optical system according to claim 133, wherein a number of the turning mirrors is one.

139. (NEW) The catadioptric optical system according to claim 138, wherein the turning mirror is arranged in the optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

140. (NEW) A catadioptric optical system comprising:

a first refractive optical sub-system;

a refractive-reflective optical sub-system;

a turning mirror; and

a second refractive optical sub-system;

wherein:

said first refractive optical sub-system forms an intermediate image of an object in an optical path between said first refractive optical sub-system and said refractive-reflective optical sub-system,

said refractive-reflective optical sub-system forms an image of said intermediate image in an optical path between said refractive-reflective optical sub system and said second refractive optical sub-system,

the turning mirror is arranged near the intermediate image and/or near the image of the intermediate image, and

the intermediate image and/or the image of the intermediate image forms in an optical path between the turning mirror and the refractive-reflective optical sub-system.

141. (NEW) The catadioptric optical system according to claim 140, wherein the turning mirror is arranged in the optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

142. (NEW) The catadioptric optical system according to claim 140, wherein each of the first refractive optical sub-system and the second refractive optical sub-system comprises a field lens which is disposed near the intermediate image and/or the image of the intermediate image.

143. (NEW) The catadioptric optical system according to claim 142, wherein:

the field lens of the first refractive optical sub-system is adjacent to the intermediate image, and

the field lens of the second refractive optical sub-system is adjacent to the image of the intermediate image.

144. (NEW) The catadioptric optical system according to claim 143, wherein each of the field lenses has a positive refractive power.

145. (NEW) The catadioptric optical system according to claim 142, wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

146. (NEW) The catadioptric optical system according to claim 142, wherein the catadioptric optical system images through unobscuration of an imaging light beam.

147. (NEW) The catadioptric optical system according to claim 142, wherein the turning mirror turns an optical path at right-angles.

148. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image;

second refractive optical means for guiding a light from the intermediate image; and

a turning mirror arranged near the intermediate image and/or near the image of the intermediate image.

149. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image; and

second refractive optical means for guiding a light from the intermediate image,

at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system and an optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system turned at right angle.

150. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image;

second refractive optical means for guiding a light from the intermediate image; and

a means for providing unobscuration.

151. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image; and

second refractive optical means for guiding a light from the intermediate image,

wherein:

the first refractive optical means comprises a first field lens arranged near the intermediate image, and

the second refractive optical means comprises a second field lens arranged near the image of the intermediate image.

152. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image; and

second refractive optical means for guiding a light from the intermediate image,

wherein the catadioptric optical system forms a final image of the object at a finite distance onto an image surface at the finite distance.

153. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image;

second refractive optical means for guiding a light from the intermediate image;

a first lens;

a second lens; and

a pupil which is formed in a space between the first and the second lens.

154. (NEW) A catadioptric optical system comprising:

a first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image; and

second refractive optical means for guiding a light from the intermediate image,

wherein a turning mirror is not in an optical path of the first refractive optical sub-system and the second refractive optical sub-system.

155. (NEW) A catadioptric optical system comprising:

first refractive optical means for forming an intermediate image of an object;

refractive-reflective optical means for forming an image of the intermediate image;

second refractive optical means for guiding a light from the intermediate image; and

a turning mirror which is disposed in at least one of an optical path between the first refractive optical sub-system and the refractive-reflective optical sub-system, and an optical path between the refractive-reflective optical sub-system and the second refractive optical sub-system.

156. (NEW) An imaging method comprising:

forming an intermediate image of an object with a first refractive optical system;

forming an image of the intermediate image with a refractive-reflective optical system;

guiding a light from the image of the intermediate image with a second refractive optical system; and

turning at least one of an optical path near the intermediate image and optical path near the image of the intermediate image.

157. (NEW) The imaging method according to claim 156, wherein the optical path turned at right angle.

158. (NEW) An imaging method comprising:

forming an intermediate image of an object with a first refractive optical system;

forming an image of the intermediate image with a refractive-reflective optical system; and

guiding a light from the image of the intermediate image with a second refractive optical system,

wherein the first refractive optical system, the refractive-reflective optical system, and the second refractive optical system have an unobscuration feature.

159. (NEW) An imaging method comprising:

forming an intermediate image of an object with a first refractive optical system;

forming an image of the intermediate image with a refractive-reflective optical system; and

guiding a light from the image of the intermediate image with a second refractive optical system,

wherein:

the intermediate image is formed by a first field lens which is arranged near the intermediate image and which belongs to the first refractive optical system, and

the image of the intermediate image is formed by a second field lens which is arranged near the image of the intermediate image and which belongs to the second refractive optical system.

160. (NEW) An imaging method comprising:

forming an intermediate image of an object with a first refractive optical system;

forming an image of the intermediate image with a refractive-reflective optical system; and

forming a final image with a second refractive optical system, based on a light from the image of the intermediate image,

wherein the final image of the object at a finite distance onto an image surface at the finite distance.

161. (NEW) An imaging method comprising:

forming an intermediate image of an object with a first refractive optical system;

forming an image of the intermediate image with a refractive-reflective optical system;

guiding a light from the image of the intermediate image with a second refractive optical system; and